551856

Dr. Jacob D. Paz
J&L Environmental Services Inc.
PO. Box 33036
Las Vegas, NV 89133
E-mail jlinc-lv@worldnet.att.net
(702)-309-3780

RECEIVED
OCT 1 0 2001

Since, I am unable to attend this Public hearing I requested that Ms. Sally Devlin make the following comments behalf of myself:

1. An unseated issue, which must be addressed by additional research, is the issue of hormesis. What is hormesis? Hormesis has been defined as a dose-response relationship in which a stimulatory response at a low dose occurs, but has a toxicologically inhibitory response at high dose. The issue is debating within the scientific community. Why it is important as an issue to Nye County residents, because some people will argue that drinking contaminated water from YMP will improve your health. Therefore you should move to live Nye County and it will increase your life expectancy from 70 to 120 year or more. I drought if such arguments has scientific validity. While other researcher will point out that stated that: 1). Hermetic effects are weak and inconsistent, and subject to large statistical errors. 2). It is unclear how can hormosis incorporate into regulatory framework when the beneficial health effects exceed the requirement for protection. 3). How can we quantified the effects of small dose? And least lack of clear experimental date.

2. The projected increase in excess or the 3 to 4% of cancer rate in worker reported in the EIS raises several questions dose the increase in cancer rate is within the regulatory cancer rate limits? Is the increase in cancer rate is acceptable or unacceptable risk? Dose it violate US Supreme Court ruling of Cancer rate of 1in 1000 for employee? The projected YMP in the EIS is an increase of cancer rate in YMP employee would be between 3 to 4 in 1000. What the potential about synergism or an additive effect of mixed irradiation exposure?

(10)

RECEIVED

OCT 1 0 2001

Dr. Jacob D. Paz
J&L Environment Services Inc.
Las Vegas, NV 89133

These Comments will be address by Sally Devlin

1. **Microbial Oxidation Reduction of Metals**

   Microorganisms appear to plays an important role the oxidation/reduction mediation Eh, and the oxidation/reduction of Chromium, and the migrations of heavy metals. The function of microorganism in the oxidation/reduction, corrosion and migration of heavy metals in YMP unsaturated, saturated zone should to be addressed by additional research (list of references will be provided upon request). I do believe that the rate of chromium releases rate into the biosphere is remains uncertain and needs further examination. There is a very good probability potential for elevated levels of Cr^{+6} in the unsaturated, saturated zone included the groundwater, and the potential increases of human health risk.

2. **Hormesis**

   An unseated issue, which must be addressed by additional research, is the issue of hormesis in conjunction with complex mixtures. What is hormesis? Hormesis has been defined as a dose-response relationship in which a stimulatory response at a low dose occurs, but has a toxicologically inhibitory response at high dose. The issue is highly debating within the scientific community Researchers stated that: 1). Hermetic effects are weak and inconsistent, and subject to large statistical errors. 2). It is unclear how hormesis can be incorporated into regulatory framework when the beneficial health effects exceed the requirements for protection. 3). How can we quantify the effects of small dose? 4). In addition there is lack of clear experimental data in the literature showing hormesis effects.

3. **Workers and Cancer Rate**

   The projected increase in of cancer rate in workers reported in the EIS, raises several questions dose the increase in cancer rate is within the regulatory cancer rate limits? Dose it violate US Supreme Court ruling of Cancer rate of 1in 1000 for employee? What the potential synergism or an additive effect of mixed irradiation exposure to toxic chemicals of employees is unknown.

1. Introduction

The question should be asked should Yucca Mountain be approved as High Nuclear Repository? At the present time there are major uncertainties and insufficient scientific data, which has been ignored or has not been completely investigated by YMP. There is a definite need for additional investigation before YMP, could be approved as a high nuclear repository. My conclusions is based upon analysis and review of the Environmental Impeach Statement (EIS), Supplement to the EIS, the Science Engineering reports, the US Environmental Agency publications and the professional literatures. Here are my comments:

2. Yucca Mountain Project

Yucca Mountain Repository probably will become some at that time in the near future, Resource Conservation and Recovery Act (RCRA), a Comprehensive Environmental Response Compensation and Liability Act (CERCLA), and finally a Mixed Waste site. Due to the corrosion of canisters and engineering barriers containing heavy metals as well as possible escaping radioactivity needs to be consider. While the YMP management has the duty to disclose and communicate this potential hazard to the public, the draft EIS and the supplement to the EIS had ignores it. The U.S. Environmental Protection Agency (EPA) has set very stringent requirements concerning the long-term risk from RCRA and CERCLA sites containing heavy metal carcinogens to ensure the safety of the public in perpetuity. These regulations stand in sharp contrast to the requirements contained inapplicable laws and regulations protect the public from the effects of a geologic repository containing nuclear waste for only 10,000 years. The long-term assessments of risks associated with heavy metals mixtures are lacking in the EIS and its supplements.

The land disposal restrictions and requirements set by the U.S. Environmental Protection Agency (40 CFR 268) for (RCRA) metal carcinogens currently specify stated that land disposal sites cannot be located in seismically active regions cited by Okrent and Xing, (1). They further noted that there is an inconsistency in current regulations and practices such as the approval of YMP as a high nuclear waste repository. Specifically, there is a very strong probability that YMP will not be in compliance with both RCRA act (40 CFR 268). The questions to be e asked how YMP Finally, could YMP provide a very clear assurance and an experimental data that that YMP will not become a RCRA site and finally a Mixed Waste Site. A request for exemption by several US Industry from RCRA regulations, has been had been denied by the USEPA (2). Therefore, if the law is applied equally why should YMP receive such exemption from RCRA regulations? To end with, what is the EPA position and how they are going to enforced their own regulations and standards. Finally, undercurrent EPA regulations, requires that a RCRA site can not be located in seismic active region and it should not be in 100 year flood plain Okrent and Xing, (1).

3. Sorption of Heavy Metals and Radionuclides

Upon reviewing the YMP EIS, the supplement to the EIS, and the YMP Science and Engineering Report, I have noted that the estimation of the releases rates of heavy metal and radionuclides from the proposed repository may be in error: I is appear that YMP scientist had failed properly to investigate the effects of heavy metals mixtures such as; Ni, Co, Cr, and Mo; and radionuclide mixtures on Zeolite sorption rate, affinity, break-point, and the potential replacement and the release rats of heavy metal and radionuclides into the environment. There is a good probability of an increase over the estimates of heavy metals or radionuclides release into the biosphere: At the present time, the health risk pose to populations, as calculated by YMP remains uncertain and needs additional study. Further more, most of Zeolites sorption studies were carried in small laboratory batch and should be addressed by additional research using large columns, and field experiments. Major errors could result from scaling results up from lab experiments to field situations without adequate validation.

In order to assess the public health risk associated with the behavior of radionuclides in the environment, knowledge of the partitioning of each radionuclide between different phases is required. This requires information on the basic physicochemical properties of the radionuclide, soil/mineral surfaces, and colloids/particulates and dissolved complexes. A distribution coefficient (K_d value) describes the partitioning of a radionuclide between the solid and aqueous phase of a system and ultimately provides an estimate of radionuclide's transport velocity via the groundwater pathway.

For the Yucca Mountain performance assessment, much attention has been given to radionuclide sorption in the near field. Numerous laboratory experiments have conducted to determine the K_d of individual heavy metals and radionuclides on devitrified tuff, vitrified tuff and zeolitic tuff. Little attention has been given to sorption on alluvial sediments in the far field. Studies of heavy metal and radionuclide sorption on alluvial typical of the Amargosa Desert are limited. Only those elements that demonstrated the least sorption on tuff, and hence are expected to migrate fastest and provide the greatest human hazard were considered in the far field in the performance assessment of Yucca Mountain. These were the long-lived radionuclides ^{237}Np, ^{99}Tc and ^{129}I [i].

When modeling sorption interactions, the Yucca Mountain performance assessment did not consider competing effects of radionuclides and heavy metals. While sorption properties of individual radionuclides and heavy metals may be known (mostly in the near field), change in this properties when two or more radionuclides and heavy metals are present is not. For instance, a canister must degrade before the radionuclides can be released. Therefore, heavy metals such as Ni, Cd, Cr, Mo and T will migrate from the site first. These ions will likely occupy the sorption sites on the soil particles with the greatest infinity for cation sorption, rendering these sites unavailable the radionuclides that are later released. Depending on the concentration these metals, the subsequent sorption of radionuclides may be significantly reduced. This will result smaller than otherwise predicted distribution coefficients, (K_d values), increased migration velocity of the radionuclide, and greater potential health hazard.

4. Chromium Oxidation

YMP ahs concluded that the canister corrosion by contact with rock, would promote the formation of Silicate can reduce Cr^{+6} to Cr^{+3} was reported by Eary and Rai (3); he further noted that the rate of reduction of Cr^{+6} is also influence by the organic matter and HS^-. Reduction of Cr^{+6} and by microorganisms under anaerobic condition s was been reported in the literature by Martin et al (4). Palmer and Puls (5); reported that the oxidation of Cr^{+3} to highly toxic Cr^{+6} is carried out by oxygen and Manganese dioxide (MnO_2). Equation 1.is illustrates the oxidation of Cr^{+3} to Cr^{+6} by MnO_2.

$$Cr(OH)^{+2} + 1.5MnO_2 ===\rightarrow HCrO^-_4 + 1.5\ Mn^{+2} \qquad \text{Eq. 1.}$$

Additionally, chromium Cr^{+6} is a highly toxic and carcinogen species in oxidation state Cr^{+6} can be reduced by Fe^{+3} to less toxic species Cr^{+3} a shown

However, review of Appendix I. pp I-17 and TRW199b, it appears that YMP-EIS did not investigate the oxidation of Cr^{+3} to Cr^{+6} by manganese oxidation in the unsaturated saturated zone and in appropriate aquifer should be further investigated. In spite of Zielinski (6) having reported the present of manganese oxide at various locations at NTS and YMP in large quantities. The EQ6 simulation computer model in the EIS Appendix I. did not clearly provide a clear data shows oxidation of Cr^{+3} to Cr^{+6} by MnO_2. The information reported remains uncertain needs further input and probably additional research.

In addition, microbial appear to play an important role the oxidation/reduction mediation Eh; the oxidation/reduction of Chromium; and the migrations of heavy metals at Yucca Mountain. The function of microorganism in the oxidation/reduction, corrosion and migration of heavy metals in YMP unsaturated, saturated zone should to be addressed by additional research. I do believe that the rate of chromium releases rate into the bios remains uncertain and needs further examination. There is a very good potential for elevated levels of Cr^{+6} in the unsaturated, saturated zone included the groundwater, and the potential increases of human health risk.

5. The Nevada Test Site Groundwater Contamination

The historic activities at NTS include atmospheric weapon testing, underground nuclear testing, and safety testing of nuclear weapons, nuclear weapons development, and the disposal of low levels of radioactive waste. From 1951 to 1992 more then 820 underground nuclear tests and 100 atmospheric tests were conducted at NTS. About 820 underground nuclear tests have had been conducted at the Nevada Test Site. Of these 259 tests are presumed to have an impact on groundwater. Of these 112 were detonated below the water table. Tritium is the radionuclide of major concern because of its transportation properties, Hechanova and Hodge (9). The reported a tritium inventory of 69.9 MCi in the Pahute Mesa region and 30.7 MCi in the other regions of NTS.

The total underground radiological contamination of all radionuclides is about 310 MCi essentially all from underground testing. However, the 112Mci underground radiological source term considered in the EIS as being available for potential migrations is just the total from all underground tests that were conducted beneath the water table or within 101 Meter of the top of the water table, and 90% of this is tritium DOE (10) and Croff (11). The toxic materials present after nuclear detonation occur in three locations: 1). Incorporated into the melted glass pools in the bottom of the cavity, 2). Deposited on the rubble and along fractured surfaces within and outside of the cavity, and 3). Finally, the gases that are escape into the atmosphere within a short time after detonation of a nuclear device. The distribution of radionuclides is complex, and their behavior or deposition is not well understood Smith (12).

There is considerable uncertainty concerning the actual quantity of radioactivity that can be mobilized by leaching of contaminated subsurface debris by groundwater. Smith et al., (13) have summarized the uncertainties associated with leaching for the NTS and concluded that the radionuclides most likely to become mobile and migrate via the groundwater regime are: (1) tritium; (2) a number of anions and neutral species such ac Tc-99, Ru-106, Cl-36, and I-129, all assumed to migrate at the same rate as groundwater; and (3) cationic species, including Sr-90, Cs-137, Co-60, Zr-95, Pu-239, and others, that are believed to move more slowly than groundwater to varying degrees. It should be noted that Zr--95, and Ru-106, all have half-lives less than three years and are not likely to pose a groundwater hazard; the same is probably true for cobalt-60 with a half-life of 5.2 years. However, the quantitative estimates are highly uncertain to the point of being almost non-existent. There has been essentially no study of whether the substantial fraction of the radiological source term that was deposited above the water table is moving downward into the saturated zone Borg, et al.,(14); and Kcrsting et al., (15).

The situation related to retardation of radionuclides transportation and by sorption into or onto rocks is somewhat better known than for leaching, with several studies having been conducted. Tritium is appropriately assumed to move at the same rate as the groundwater. However, documentation for most other radionuclides indicates that retardation factors vary significantly with respect to water composition, experimental conditions, and rock type. The causes of the variations are speculative Smith, (13). In fact, Daniels, (16) assumed no sorption of any radionuclides because of the limited database. Insoluble or highly retarded radionuclides can be transported by forming or attaching to colloidal particles, which then move essentially at the same rate as the groundwater in which they reside. Kersting, (17) concluded that a substantial fraction of radionuclides could be associated with colloids, but the effects on transportation are not known. Contaminant transport by non-radioactive organic chemicals or degradation products thereof has not been studied or taken into account.

Pahute Mesa, which is the location of most of the U.S. large nuclear explosions, contains approximately 70 percent of the tritium at the NTS. Modeling results also indicate that groundwater flow paths from Pahute Mesa are the shortest of all those at the NTS site and constitute the highest potential for contamination migration to off-site public receptors IT Corporation (18). From recent analysis of water from a well near the TYRO nuclear weapon test site on Pahute Mesa the experimental data show that Pu-239 seem to be immobilized in groundwater; however, tests of two wells near the TYBO underground nuclear test at Pahute Mesa, at the Nevada Test Site do not confirm this. Test results showed that presence of Pu-239 in association with colloids, found at significant levels in well number ER-20-5 #1 at a depth of 860 m. While, at well number ER-20-5 #3 30. m south of #1 only a very small amount of Pu-239 was detected, Kersting et al.,(19). All of the Pu-239 detected was shown to be associated with colloidal particles.

The GeoTrans (20) carried out tests for tritium; the experimental data were far below 20,000 pCi/L., which is EPA's allowable tritium concentration in drinking water. The study reported by Daniels (15) predicted much higher values. The estimated range of peak tritium concentrations at the closest uncontrolled use area varies from $5x10^{-4}$ pCi/L (arriving 150 years after the beginning of migration) to 3,800 pCi/L (arriving in 25 to 94 years). The hypothetical maximally exposed individual at this location is estimated to have a lifetime probability of contracting a fatal cancer between 8×10^{-12} (about one in one trillion) and 1×10^{-5} (about one in 100,000), depending on which model is used. These estimates are self-characterized as being conservative. The results indicate that at the Area 20 (Pahute Mesa) boundary of the NTS and at Oasis Valley the lifetime committed effective dose for other radionuclides is about 10 percent of that from tritium. Important radionuclides other than tritium were Sr-90, I-129, Cs-137, Ra-226, Pu-239, and Am-241. The risks from toxic chemicals resulting from weapons tests have not been estimated.

Of the big major concern is that the facts that the Underground Test Area Program (UGTA) strategy does not utilize risk as a major factor in how and where the DOE applies its resources to protect human health from contaminated groundwater at the NTS. Since the DOE does not have enough data to define adequately the hydrologic source term, an acceptable risk assessment for the groundwater contamination cannot be properly developed at this point. The baseline risk assessment for the NTS groundwater contamination is described as incomplete since it only characterizes the radioactive isotope tritium. Both YMP and NTS risk assessment ignored the potential health effect of mixed irradiation and toxic chemicals required data are unavailable or uncertain and this matter must be further investigated.

The focus on tritium is logical because it enters the groundwater easily since it is an isotope of hydrogen, and it has the highest inventory of any radionuclides at the NTS. But other radionuclides may travel as conservatively as tritium, and not be retained in the aquifer materials contaminated by testing. Np-237, Tc-99 are thought to be isotopes that can simulate tritium-like migration. In fact, neptunium is the major long-term culprit predicted to carry contamination from Yucca Mountain to offsite, down gradient locations. Since the DOE does not know the concentration of all radionuclides in the groundwater from nuclear testing, it cannot conduct an acceptable risk assessment for UTGA problem. If the UGTA strategy were to incorporate risk as a driver in the quest to understand, locate, and protect human health from contaminated groundwater, then one must look to the northwestern section of the NTS called the Pahute Mesa area. Pahute Mesa is where the largest and deepest underground nuclear tests were conducted in the volcanic rock aquifers. Specifically, in the western Pahute Mesa area some shots were conducted so close to the NTS boundary that contamination may have been injected off the NTS and into U.S. Air Force lands. YMP management had failed to incorporate NTS risk assessment into YMP risk assessment, the current projected cancer risks to public in the Draft EIS needs a major revision.

6. Risk Assessment Exposure of Complex Mixtures

Both the Environmental Protection Agency (EPA) and the Nuclear Regulatory Commission (NRC) have proposed radiation standards for drinking water near the YMP. The EPA (21) had issued a radiation protection standard of 15-mRem effective dose per year for YMP: While the NRC proposed corresponding radiation standard of 25 mRem. In addition the EPA is set a drinking water standard of 4 mRem at the nearest accessible site to Yucca Mountain. The EPA applied a cancer risk factor ranging from 10^{-6} to 10^{-4}, to be consistent with the existing policy under the Comprehensive Environmental Response, Compensation and Liability Act; and more recently, the Food Quality Protection Act. The Food Quality Protection Act requires a cancer standard risk factor of no greater than 10^{-4}.

The EPA acknowledged that most radioactive sites are also contaminated with non-radiological toxic chemicals, but they failed to take into account the potential synergistic or antagonistic interactions of toxic chemicals with radionuclides at low concentrations. Neither the Department of Energy (DOE) nor the NRC has regulations or policies to address the possible problem associated with chemical interactions with radionuclides. The NRC has proposed a protection standard of 25 mRem effective dose per year for YMP (22) based on an acceptable cancer risk of 1 in 1000.

Recently, there has been an increasing concern among regulatory agencies and the public over the exposure to and possible adverse effects from exposure to complex mixtures of environmental pollutants (toxic chemicals). The EPA in 1986 and in 1990 (23-24) recognized the importance of complex mixtures and issued guidelines for the risk assessment of complex mixtures. The National Research Council (NRC) in 1988 (25) addressed concerns regarding exposures to complex mixtures. The Presidential/Congressional Commission on Risk Assessment and Risk Management in 1977 (26) stated that it "considered the risk assessment of mixtures to be a matter of considerable concern and importance." Additionally, the National Council on Radiation Protection and Measurements (NCRP), in 1993 (25), specifically acknowledged that a gap exists between chemical and radiation risk estimate. In addition, the NCRP confirmed that further study is needed to address issues such as damage to the immune system, and possible combined effects of chemicals and irradiation causing either synergistic or antagonistic effects.

In addition, RCRA Section 3004(m), which is, requires EPA to "promulgate regulations specifying those levels or methods of treatment, if any, which substantially diminish the toxicity of the waste or substantially reduce the likelihood of migration of hazardous constituents from the waste". On January 14, 1986, EPA proposed an approach for developing treatment standards under 3004(m) using technology-based levels determined by the performance of Best Demonstrated Available Technologies (BDAT) in conjunction with risk-based standards (screening levels). After receiving extensive comment on the proposed rule, EPA chose to promulgate only the technology-based level or BDAT approach. The U.S. Court of Appeals for the D.C. Circuit upheld EPA's technology-based approach to LDR; Hazardous Waste Treatment Council vs. EPA, 886 F. 2d (D.C. Cir. 1989).

Recently, there has been an increasing concern among regulatory agencies and the public over the exposure to and possible adverse effects from exposure to complex mixtures of environmental pollutants (toxic chemicals). The EPA in 1986 and in 1990 (23-24) recognized the importance of complex mixtures and issued guidelines for the risk assessment of complex mixtures. The National Research Council (NRC) in 1988 (25) addressed concerns regarding exposures to complex mixtures. The Presidential/Congressional Commission on Risk Assessment and Risk Management in 1977 (26) stated that it "considered the risk assessment of mixtures to be a matter of considerable concern and importance." Additionally, the National Council on Radiation Protection and Measurements (NCRP), in 1993 (25), specifically acknowledged that a gap exists between chemical and radiation risk estimate. In addition, the NCRP confirmed that further study is needed to address issues such as damage to the immune system, and possible combined effects of chemicals and irradiation causing either synergistic or antagonistic effects.

7. Mixed Irradiation Risk Assessment Models

Several models has been proposed for the simulated the action of mixed irradiation with two types of radiation have been proposed in the last two decades, but YMP management failed to include them in the EIS. Mixed irradiation is sometimes composed of more than two types of radiation, and for this type of mixed irradiation, no model has yet been proposed. It is of importance to assess the effect of mixed irradiation in terms of the environment, groundwater contamination, transportation accidents, space, and medicine. Theoretical models for mixed irradiation with two types of radiation have been presented by Zaider and Rossi (27); and by Scott (28) based on the Theory of Dual Radiation; Tobias et al., (29); Ager and Haynes (30); Lamb (31); Suzuki (32) also have analyzed the action of mixed irradiation using their own models. However, mixed irradiation is sometimes composed of more than two types of radiation. Suzuki (33) has developed a model that can be applied to any type of mixed irradiation (i.e.. any time-lag) with two types of radiation (i.e., the extended Zaider-Rossi model).

20. GenTrans. Ins. A Fracture/Poxous Media Model of Tritium Transport in the Underground Weapons Testing Areas. Nevada Test Site. GooTrans, Ins., Boulder, Colo. 1995

21. Federal Register Part II. Environmental Protection Agency, 40CFR Part 197 Environmental Protection Radiation Standard for Yucca Mountain Project, Final Rule August 14, 2001.

22. Federal Registrar Part II. Nuclear Regulatory Agency, 10 CFR Part 19. Disposal of High –Level Radioactive Waste in a Proposed Geological Repository at Yucca Mountain, Nevada; Proposed rule, February 22, 1999.

23. EPA Guidelines for health Risk Assessment of Chemical Mixtures, Fed. Regist. 51, (185), 3414-24025, 1986.

24. EPA Risk Assessment Guideline for Superfund Vol. I. Part A. EPA/540/1-89/002

25. The National Research Council, Complex Mixtures, Methods for In Vivo Toxicity National Academy Press Washington. D.C.,1988.

26. The Presidential Congressional Commission on Risk Assessment and Risk Management 1997.

27. National Council on Radiation Protection Measurements (NRCP), Research needs for Radiation. NCRP ReportNo.117, NCRP Press, Bethesda, MD, 1993.

28. Zaider. M., and Rossi. H. H., Radiat. Res. 83: 732-739, 1980.

29. Scott. B. R., Bull. Math. Biol. 45: 323-3-16, 1983.

30. Tobias. C. A., Blakely. E. A., Ngo. F. Q. H., and Young, T. C. H., The repair-miss-repair model of cell survival. In: Radiation Biology in Cancer Research. Ed. Withers, H.R. M., pp. 195-230, Raven Press. New York, 1980.

31. Ager. D. D., and Haynes. R. H., Radiat. Res. 110: 129-1141, 1987.

32. Lam. G. K. Y., Radiat. Res. 110: 232 –243, 1987.

33. Suzuki. S., (1994). Radiat. Res.,138: 297-301, 1994

34. Suzuki. S., Environ. Health Perspec. Suppl. 105: I-155-1 158.

35. Suzuki S., Radiat. Res 39:215-221,1998.

36 Biokintetic Models for Radionuclides In; Cancer Risk Coefficients for Environmental Exposure to Radionuclides EPA 402-R-99-01, pp 145-156, 1999.